UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/560,555	04/28/2000	David L. Stephenson	15-4-910.00	3306

7590 11/10/2004	EXAMINER
Sterne Kessler Goldstein & Fox PLLC	WOOD, WILLIAM H

Sterne Kessler Goldstein & Fox PLLC
Attorneys at Law
Suite 600
1100 New York Avenue NW
Washington, DC 20005-3934

ART UNIT	PAPER NUMBER
2124	

DATE MAILED: 11/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	09/560,555	STEPHENSON ET AL.
	Examiner	Art Unit	
	William H. Wood	2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>24 June 2004</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-44</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-44</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claims 1-44 are pending and have been examined.

Information Disclosure Statement

1.   The information disclosure statement filed 02 July 2003 fails to comply with 37

CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each

publication or that portion which caused it to be listed; and all other information or that

portion which caused it to be listed. It has been placed in the application file, but the

information referred to therein has not been considered by the current Examiner

assigned to the prosecution of the Application (though a previous Examiner has

considered the cited documents). A copy of the cited references or indication of

previous submission is required in order to complete the record of prosecution.

Claim Objections

2.   Claim 37 is objected to because of the following informalities: claim is a

duplicate of claim 33. Claim 37 might be more appropriate under claim 14. Appropriate

correction is required.

Claim Rejections - 35 USC § 112

3.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly
> claiming the subject matter which the applicant regards as his invention.

4.   Claims 17-19 are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention. Claim 17 recites the limitation "the tree" in line 3.

There is insufficient antecedent basis for this limitation in the claim. Possible correction

may include making claim 17 dependent upon claim 16 (it will be treated as such in the

below rejections).

Claim Rejections - 35 USC § 103

5.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

6.   Claims 1, 20-26 and 27-32, 33-39 and 40-44 rejected under 35 U.S.C. 103(a) as

being unpatentable over **Bortnikov** et al. (USPN 6,029,004) in view of **Goebel** (USPN

6,139,200).

Claim 1

Bortnikov disclosed a method for precise feedback data generation and updating

during compile-time optimizations, within an optimizing compiler, comprising:

(1) accessing a first intermediate representation of source code of a computer program,

wherein said first intermediate representation includes instructions instrumented into the

source code of said computer program *(column 4, lines 11-20)*;

(2) annotating said first intermediate representation with previously-gathered frequency data from a plurality of sample executions of said computer program *(column 5, lines 18-31);*

(3) updating said frequency data *(column 5, lines 18-21);*

(4) performing an optimization of said first intermediate representation annotated with said frequency data updated in step (3), thereby producing a transformed intermediate representation *(column 2, line 65 to column 3, line 16);*

Bortnikov did not explicitly state *repeating steps (3) and (4) at least once during the same compilation pass; and updating frequency data to maintain accuracy in a direction of increasing exactness.* **Goebel** demonstrated that it was known at the time of invention to use feedback updates of increasing exactness for reiterative optimization (figure 5, elements 540 and 570; column 8, lines 30-40; column 9, lines 31-37; column 10, lines 10-20). It would have been obvious to one of ordinary skill in the art at the time of invention to implement the optimizing compiler of **Bortnikov** with single pass optimization refinement techniques as found in **Goebel**'s teaching. This implementation would have been obvious because one of ordinary skill in the art would be motivated to increase efficiency and desirability of executable code through refined and detailed optimizations (**Goebel**: column 8, lines 30-40; column 10, lines 63-67).

Claim 20

The limitations of claims 20 are substantially similar to claim 1 and a such are rejected in the same manner.

<u>Claim 21</u>

Bortnikov and **Goebel** disclosed the method claim 1, wherein said frequency data comprises both inexact and exact values *(**Bortnikov**: column 3, line 51 to column 4, line 20; static profiling produces inexact guesses and dynamic produces exact results)*.

<u>Claim 22</u>

Bortnikov and **Goebel** disclosed the method claim 1, wherein said updating step updates said frequency data from GUESS to EXACT values *(**Bortnikov**: column 3, line 51 to column 4, line 20; static profiling produces GUESS, UNKNOWN and ERROR and dynamic produces EXACT, UNINIT and ERROR ; **Goebel**: column 10, lines 1-9; increasing update exactness)*.

<u>Claim 23</u>

Bortnikov and **Goebel** disclosed the method claim 1, said updating step updates said frequency data from UNKNOWN to GUESS values *(**Bortnikov**: column 3, line 51 to column 4, line 20; static profiling produces GUESS, UNKNOWN and ERROR and dynamic produces EXACT, UNINIT and ERROR ; **Goebel**: column 10, lines 1-9; increasing update exactness)*.

Claim 24

Bortnikov and **Goebel** disclosed the method claim 1, wherein said updating step updates said frequency data from UNINIT to GUESS values *(Bortnikov: column 3, line 51 to column 4, line 20; static profiling produces GUESS, UNKNOWN and ERROR and dynamic produces EXACT, UNINIT and ERROR ; Goebel: column 10, lines 1-9; increasing update exactness)*.

Claim 25

Bortnikov and **Goebel** disclosed the method claim 1, wherein said optimization is performed in a direction of decreasing exactness *(Bortnikov: column 4, lines 22-33; hierarchy provides decreasing exactness; Goebel: column 10, lines 11-14)*.

Claim 26

Bortnikov and **Goebel** disclosed the method claim 1, wherein said optimization is performed locally *(Bortnikov: column 3, lines 2-12)*, and the updating is performed globally *(Bortnikov: column 3, lines 1-2)*.

Claims 27-32, 33-39 and 40-44

The limitations of claims 27-32, 33-39 and 40-44 are substantially similar to claims 21-26 and a such are rejected in the same manner.

7.   Claims 2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Bortnikov et al. (USPN 6,029,004) in view of **Goebel** (USPN 6,139,200) and in further

view of **Chaitin** et al. (USPN 4,656,582).

Claim 2

Bortnikov and **Goebel** did not explicitly state the method claim 1, wherein step (4)

comprises the step of performing at least one of the following optimizations:

(i) dead code elimination;

(ii) dead store elimination;

(iii) branch elimination; and

(iv) code transformation.

Chaitin demonstrated that it was known at the time of invention to optimize code using

dead code elimination (column 9, lines 37-40). It would have been obvious to one of

ordinary skill in the art at the time of invention to implement the optimization system of

Bortnikov and **Goebel** with dead code elimination as found in **Chaitin**'s teaching. This

implementation would have been obvious because one of ordinary skill in the art would

be motivated to make use of standard and thus easily implemented techniques for

optimizing or increasing of efficiency of code (column 9, lines 37-40).

Claim 10

The limitations of claims 10 are substantially similar to claims 2 and a such are rejected

in the same manner.

8.   Claims 3-5, 7-8, 11-13 and 16-19 are rejected under 35 U.S.C. 103(a) as being

unpatentable over **Bortnikov** et al. (USPN 6,029,004) in view of **Goebel** (USPN

6,139,200) in view of **Sabot** et al. (USPN 5,347,654).

Claim 3

Bortnikov and **Goebel** did not explicitly state the method claim 1, wherein said first

intermediate representation is a tree corresponding to a procedure within the source

code of said computer program. **Sabot** demonstrated that it was known at the time of

invention to construct compilers using internal representation trees for representing

code and various "internal" information (figure 2, elements 202 and 214). It would have

been obvious to one of ordinary skill in the art at the time of invention to implement a

compiler with internal tree representations as found in **Sabot**'s teaching. This

implementation would have been obvious because one of ordinary skill in the art would

be motivated to develop a compiler using standard (easily implemented and

understood) compiler technology (column 7, line 30 to column 8, line 29).

Claim 4

Bortnikov, **Goebel** and **Sabot** disclosed the method claim 3, wherein step (2),

comprises the steps of:

(a) constructing a control flow graph from said tree *(Bortnikov: column 3, lines 1-4)*;

and

(b) annotating a frequency value to an edge of said control flow graph, wherein said

frequency value corresponds to the number of times that said edge value was traversed

during said plurality of sample executions of said computer program *(Bortnikov:*

column 5, lines 18-31).

Claim 5

Bortnikov, **Goebel** and **Sabot** disclosed the method claim 4, wherein said frequency

value annotated to said edge of said control flow graph is one of the following:

(i) EXACT;

(ii) GUESS;

(iii) UNKNOWN;

(iv) UNINIT; and

v) ERROR *(Bortnikov: column 3, line 51 to column 4, line 20; static profiling produces*

GUESS, UNKNOWN and ERROR and dynamic produces EXACT, UNINIT and

ERROR);

Claims 7-8, 11-13 and 16-19

The limitations of claims 7-8, 11-13 and 16-19 are substantially similar to claims 3-5 and

a such are rejected in the same manner.

Response to Arguments

9.   Applicant's arguments with respect to claims 1-44 have been considered but are

moot in view of the new ground(s) of rejection.

Conclusion

10.   Applicant's amendment necessitated the new ground(s) of rejection presented in

this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37

CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later
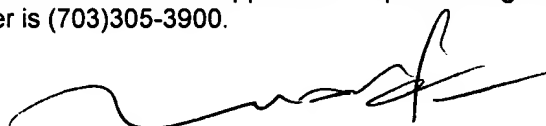
than SIX MONTHS from the date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William H. Wood whose telephone number is (703)305-3305 (after 28 October 2004: 571-272-3736). The examiner can normally be reached 7:30am - 5:00pm Monday thru Thursday and 7:30am - 4:00pm every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (703)305-9662 (after 28 October 2004: 571-272-3719). The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9306 for regular communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)305-3900.

William H. Wood
November 1, 2004

TUAN DAM
SUPERVISOR   EXAMINER